



# TEST REPORT

**APPLICANT** : Sonim Technologies, Inc.  
**PRODUCT NAME** : GSM, WCDMA, LTE Cell Phone  
**MODEL NAME** : XP3900  
**BRAND NAME** : Sonim  
**FCC ID** : WYPP14303  
**STANDARD(S)** : 47 CFR Part 15 Subpart E  
**RECEIPT DATE** : 2021-04-23  
**TEST DATE** : 2021-04-28 to 2021-05-25  
**ISSUE DATE** : 2021-06-03

Edited by:

*Zeng Xiaoying*  
Zeng Xiaoying (Rapporteur)

Approved by:

*Peng Huarui*  
Peng Huarui(Supervisor)

**NOTE:** This document is issued by MORLAB, the test report shall not be reproduced except in full without prior written permission of the company. The test results apply only to the particular sample(s) tested and to the specific tests carried out which is available on request for validation and information confirmed at our website.





# DIRECTORY

- 1. Technical Information ..... 3**
- 1.1. Applicant and Manufacturer Information ..... 3**
- 1.2. Equipment Under Test (EUT) Description ..... 3**
- 1.3. Modulation Type and Data Rate of EUT ..... 5**
- 1.4. The Channel Number and Frequency ..... 6**
- 1.5. Test Standards and Results ..... 7**
- 1.6. Environmental Conditions ..... 8**
- 2. 47 CFR Part 15E Requirements ..... 9**
- 2.1. Antenna Requirement ..... 9**
- 2.2. Duty Cycle of the Test Signal ..... 10**
- 2.3. Maximum Conducted Output Power ..... 15**
- 2.4. Emission Bandwidth ..... 20**
- 2.5. Peak Power Spectral Density ..... 59**
- 2.6. Frequency Stability ..... 100**
- 2.7. Conducted Emission ..... 103**
- 2.8. Restricted Frequency Bands ..... 107**
- 2.9. Radiated Emission ..... 127**
- Annex A Test Uncertainty ..... 158**
- Annex B Testing Laboratory Information ..... 159**

Change History		
Version	Date	Reason for change
1.0	2021-06-03	First edition



# 1. Technical Information

**Note:** Provide by applicant.

## 1.1. Applicant and Manufacturer Information

<b>Applicant:</b>	Sonim Technologies, Inc.
<b>Applicant Address:</b>	6836 Bee Cave Road, Building 1, Suite 279, Austin, Texas 78746, USA
<b>Manufacturer:</b>	Sonim Technologies, Inc.
<b>Manufacturer Address:</b>	6836 Bee Cave Road, Building 1, Suite 279, Austin, Texas 78746, USA

## 1.2. Equipment Under Test (EUT) Description

<b>Product Name:</b>	GSM, WCDMA, LTE Cell Phone	
<b>Serial No.:</b>	N/A	
<b>IMEI:</b>	Conducted	001080002706712
	Radiated	001080002707256
<b>Hardware Version:</b>	P14303: 0200 P14403: 0201(Non-camera)	
<b>Software Version:</b>	3P.2.0-01-11.0.0-19.20.16	
<b>Modulation Technology:</b>	OFDM	
<b>Modulation Mode:</b>	802.11a, 802.11n (HT20), 802.11n (HT40) 802.11ac (VHT20), 802.11ac (VHT40), 802.11ac (VHT80),	
<b>Operating Frequency Range:</b>	5180MHz-5240MHz; 5260MHz-5320MHz; 5500MHz-5720MHz; 5745MHz-5825MHz	
<b>Channel Number:</b>	Refer to 1.4	
<b>Antenna Type:</b>	Loop Antenna	
<b>Antenna Gain:</b>	1.11dBi	



<b>Accessory Information:</b>	Battery	
	Brand Name:	Sonim
	Model No.:	BAT-02300-01S
	Serial No.:	(N/A, marked #1 by test site)
	Capacity:	2300mAh
	Rated Voltage:	3.85V
	Charge Limit:	4.2V
	Manufacturer:	Tianjin Lishen Battery Joint-Stock Co., Ltd.
<b>Accessory Information:</b>	AC Adapter	
	Brand Name:	Sonim
	Model No.:	UC13US
	Serial No.:	(N/A, marked #1 by test site)
	Rated Output:	5V=2A
	Rated Input:	100-240V~50/60Hz, 0.35A
	Manufacturer:	Jiangsu Chenyang Electron Co., Ltd.

**Note 1:** According to the certificate holder, they declare that the model XP3900 (FCC ID: WYPP14303) has two types, namely "P14303" and "P14403", the difference is as follows. The main measuring model is XP3900 (Type: P14303), only the results for XP3900 (Type: P14303) were recorded in this report.

Model name	Type name	Variant
XP3900	P14303	With camera
	P14403	Without camera

**Note 2:** WiFi hotspot only support U-NII-1 and U-NII-3 band.

**Note 3:** For a more detailed description, please refer to Specification or User's Manual supplied by the applicant and/or manufacturer.



### 1.3. Modulation Type and Data Rate of EUT

Modulation Technology	Modulation Type	Data Rate (Mbps) <sup>Note1</sup>
OFDM (802.11a)	BPSK	<b>6/9</b>
	QPSK	12/18
	16QAM	24/36
	64QAM	48/54
OFDM (802.11n)	BPSK	<b>6.5</b>
	QPSK	13/19.5
	16QAM	26/39
	64QAM	52/58.5/65
OFDM (802.11ac)	BPSK	<b>6.5</b>
	QPSK	13/19.5
	16QAM	26/39
	64QAM	52/58.5/65
	256QAM	78

**Note1:** The worst-case mode (black bold) in all data rates has been determined during the pre-scan, only the test data of the worst-case were recorded in this report.

## 1.4. The Channel Number and Frequency

<b>(U-NII-1) 5180MHz-5240MHz</b>				
Bandwidth	Channel	Frequency (MHz)	Channel	Frequency (MHz)
20MHz	<b>36</b>	<b>5180</b>	40	5200
	<b>44</b>	<b>5220</b>	<b>48</b>	<b>5240</b>
40MHz	<b>38</b>	<b>5190</b>	<b>46</b>	<b>5230</b>
80MHz	<b>42</b>	<b>5210</b>		
<b>(U-NII-2A) 5260MHz-5320MHz</b>				
Bandwidth	Channel	Frequency (MHz)	Channel	Frequency (MHz)
20MHz	<b>52</b>	<b>5260</b>	56	5280
	<b>60</b>	<b>5300</b>	<b>64</b>	<b>5320</b>
40MHz	<b>54</b>	<b>5270</b>	<b>62</b>	<b>5310</b>
80MHz	<b>58</b>	<b>5290</b>		
<b>(U-NII-2C) 5500MHz-5720MHz</b>				
Bandwidth	Channel	Frequency (MHz)	Channel	Frequency (MHz)
20MHz	<b>100</b>	<b>5500</b>	105	5520
			108	5540
			116	5580
			124	5620
			132	5660
			140	<b>144</b>
40MHz	<b>102</b>	<b>5510</b>	110	5550
			118	5590
			134	<b>142</b>
80MHz	<b>106</b>	<b>5530</b>	<b>122</b>	<b>5610</b>
	<b>138</b>	<b>5690</b>		
<b>(U-NII-3) 5745MHz-5825MHz</b>				
Bandwidth	Channel	Frequency (MHz)	Channel	Frequency (MHz)
20MHz	<b>149</b>	<b>5745</b>	153	5765
	<b>157</b>	<b>5785</b>	161	5805
	<b>165</b>	<b>5825</b>		
40MHz	<b>151</b>	<b>5775</b>	<b>159</b>	<b>5795</b>
80MHz	<b>155</b>	<b>5775</b>		

**Note 1:** The black bold channels were selected for test.



## 1.5. Test Standards and Results

The objective of the report is to perform testing according to 47 CFR Part 15 Subpart E (U-NII band) for the EUT FCC ID Certification:

No.	Identity	Document Title
1	47 CFR Part 15(5-1-14 Edition)	Radio Frequency Devices

Test detailed items/section required by FCC rules and results are as below:

No.	Section	Description	Test Date	Test Engineer	Result	Method Determination /Remark
1	15.203	Antenna Requirement	N/A	N/A	PASS	No deviation
2	ANSI C63.10	Duty Cycle of the Test Signal	May 21, 2021	Su Xiaoxian	PASS	No deviation
3	15.407(a)	Maximum Conducted Output Power	May 20, 2021	Su Xiaoxian	PASS	No deviation
4	15.407(a)(e)	Emission Bandwidth	May 21&25, 2021	Su Xiaoxian	PASS	No deviation
5	15.407(a)	Peak Power Spectral Density	May 21, 2021	Su Xiaoxian	PASS	No deviation
6	15.407(g)	Frequency Stability	Apr 28, 2021	Su Xiaoxian	PASS	No deviation
7	15.207	Conducted Emission	May 08, 2021	Wu Runfeng	PASS	No deviation
8	15.407(b)	Restricted Frequency Bands	May 01&08&19, 2021	Gao Jianrou	PASS	No deviation
9	15.407(b)	Radiated Emission	May 18, 2021	Gao Jianrou	PASS	No deviation

**Note 1:** The DFS test report was documented in a separate report (Report No.: SZ21040148W05).

**Note 2:** The tests of Conducted Emission and Radiated Emission were performed according to the method of measurements prescribed in ANSI C63.102013.

**Note 3:** These RF tests were performed according to the method of measurements prescribed in KDB789033 D02 v02r01.



**Note 4:** The path loss during the RF test is calibrated to correct the results by the offset setting in the test equipments. The ref offset 12dB contains two parts that cable loss 2dB and Attenuator 10dB.

**Note 5:** Additions to, deviation, or exclusions from the method shall be judged in the "method determination" column of add, deviate or exclude from the specific method shall be explained in the "Remark" of the above table.

**Note 6:** When the test result is a critical value, we will use the measurement uncertainty give the judgment result based on the 95% risk level.

## 1.6. Environmental Conditions

During the measurement, the environmental conditions were within the listed ranges:

Temperature (°C):	15-35
Relative Humidity (%):	30-60
Atmospheric Pressure (kPa):	86-106





## 2.47 CFR Part 15E Requirements

### 2.1. Antenna Requirement

#### 2.1.1. Applicable Standard

According to FCC 15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section.

#### 2.1.2. Test Result: Compliant

The EUT has a permanently and irreplaceable attached antenna. Please refer to the EUT internal photos.

## 2.2. Duty Cycle of the Test Signal

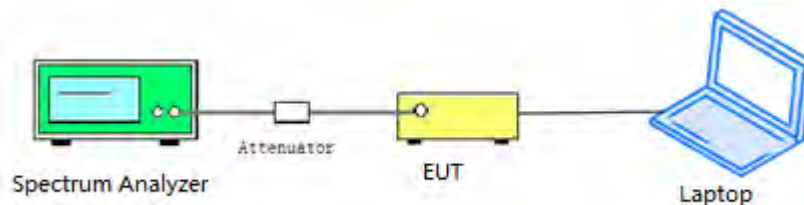
### 2.2.1. Requirement

Preferably, all measurements of maximum conducted (average) output power will be performed with the EUT transmitting continuously (i.e., with a duty cycle of greater than or equal to 98%). When continuous operation cannot be realized, then the use of sweep triggering/signal gating techniques can be used to ensure that measurements are made only during transmissions at the maximum power control level. Such sweep triggering/signal gating techniques will require knowledge of the minimum transmission duration (T) over which the transmitter is on and is transmitting at its maximum power control level for the tested mode of operation. Sweep triggering/signal gating techniques can then be used if the measurement/sweep time of the analyzer can be set such that it does not exceed T at any time that data are being acquired (i.e., no transmitter OFF-time is to be considered).

When continuous transmission cannot be achieved and sweep triggering/signal gating cannot be implemented, alternative procedures are provided that can be used to measure the average power; however, they will require an additional measurement of the transmitter duty cycle (D). Within this sub clause, the duty cycle refers to the fraction of time over which the transmitter is ON and is transmitting at its maximum power control level. The duty cycle is considered to be constant if variations are less than  $\pm 2\%$ ; otherwise, the duty cycle is considered to be nonconstant.

### 2.2.2. Test Description

#### Test Setup:



The EUT is coupled to the Spectrum Analyzer; the RF load attached to the EUT antenna terminal is 50Ohm; the path loss as the factor is calibrated to correct the reading.

### 2.2.3. Test Procedure

KDB 789033 Section B was used in order to prove compliance.

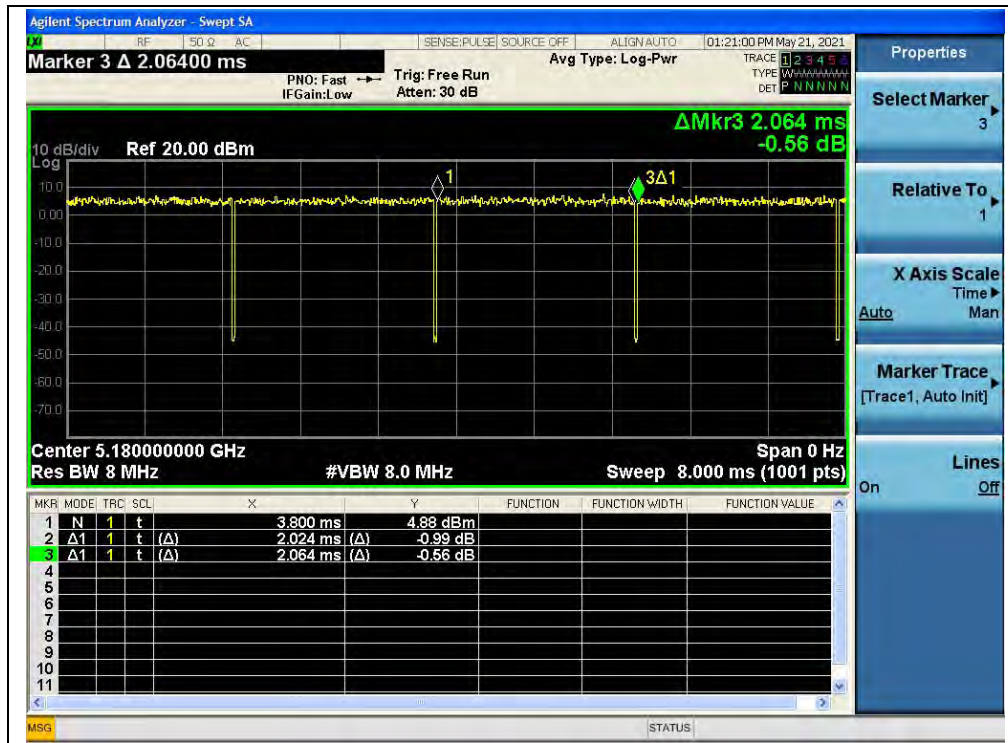


2.2.4. Test Result

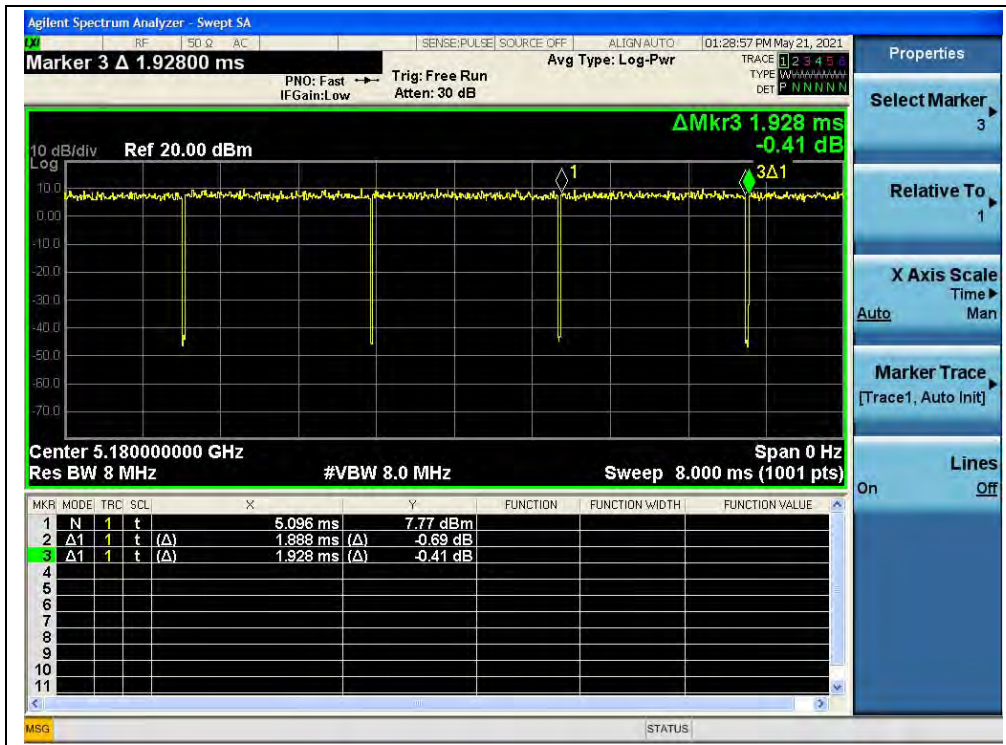
A. Test Verdict:

Test Mode	Duty Cycle (%) (D)	Duty Factor (10*log[1/D])
802.11a	98.06	0.09
802.11n (HT20)	97.93	0.09
802.11n (HT40)	96.27	0.17
802.11ac (VHT20)	97.93	0.09
802.11ac (VHT40)	96.30	0.16
802.11ac (VHT80)	92.68	0.33

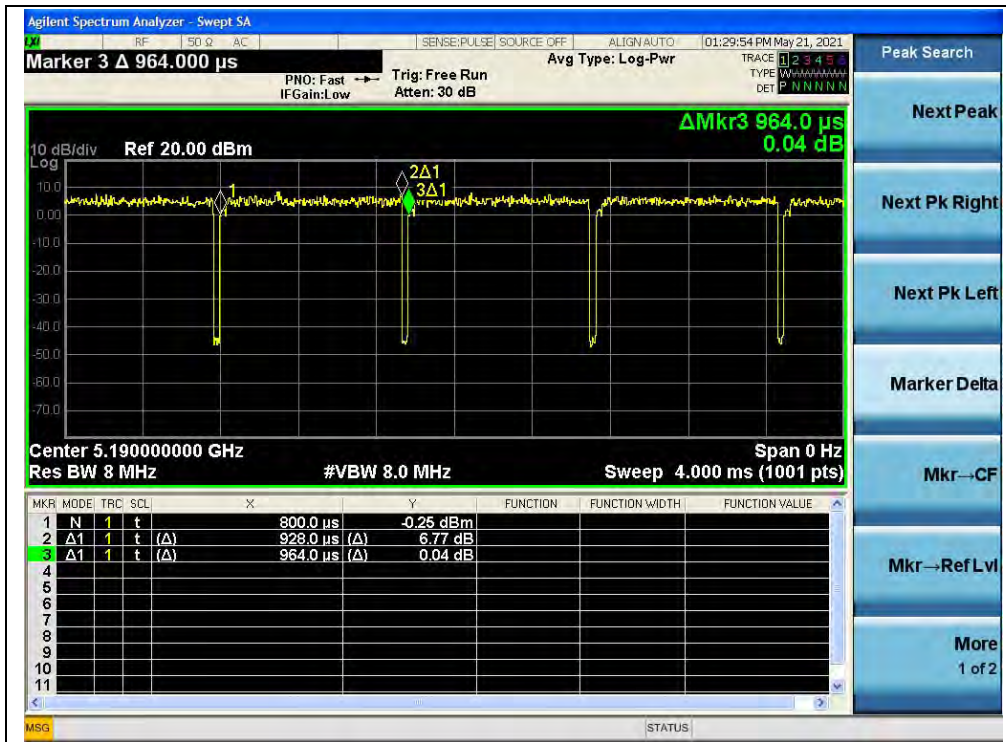
B. Test Plot:



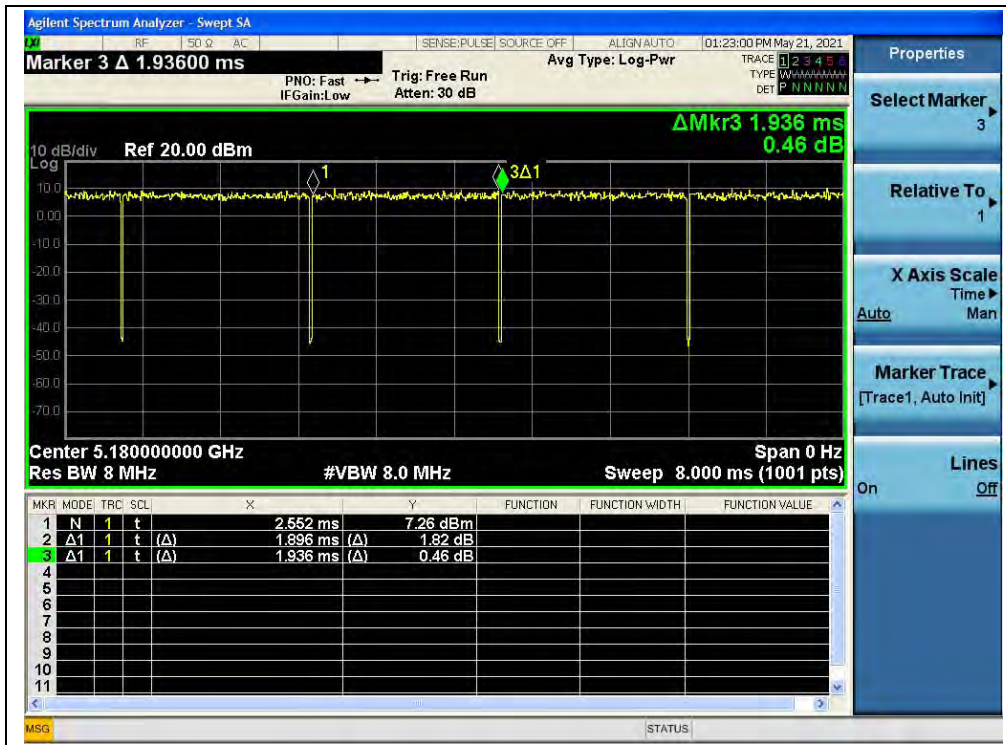
(Channel 36, 5180MHz, 802.11a)



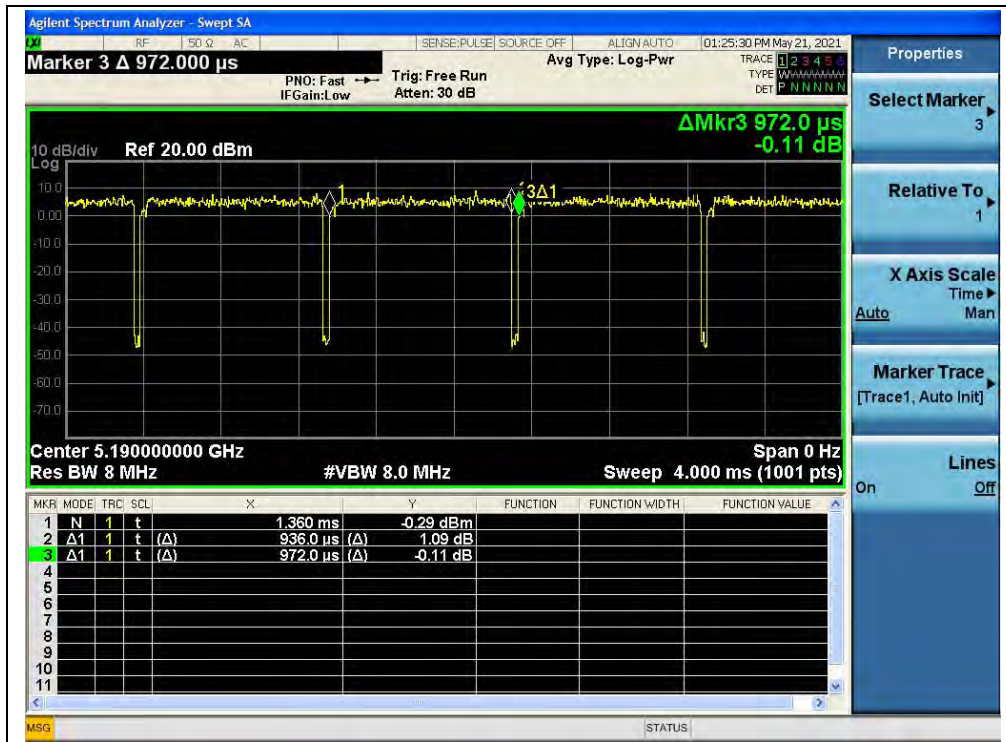
(Channel 36, 5180MHz, 802.11n (HT20))



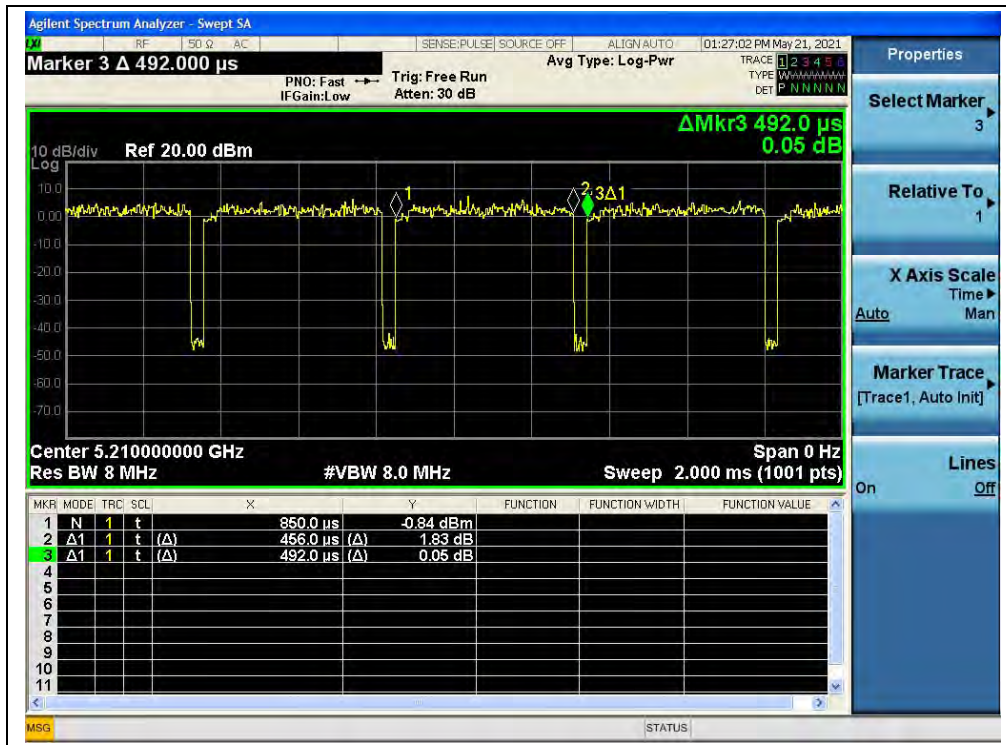
(Channel 38, 5190MHz, 802.11n (HT40))



(Channel 36, 5180MHz, 802.11ac (VHT20))



(Channel 38, 5190MHz, 802.11ac (VHT40))



(Channel 42, 5210MHz, 802.11ac (VHT80))

## 2.3. Maximum Conducted Output Power

### 2.3.1. Requirement

(1) For client devices in the 5.15-5.25 GHz band, the maximum conducted output power over the frequency band of operation shall not exceed 250mW provided the maximum antenna gain does not exceed 6dBi.

(2) For the 5.25-5.35 GHz and 5.47-5.725 GHz bands, the maximum conducted output power over the frequency bands of operation shall not exceed the lesser of 250mW or  $11\text{dBm} + 10 \log B$ , where B is the 26 dB emission bandwidth in megahertz.

(3) For the band 5.725-5.85 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W.

If transmitting antennas of directional gain greater than 6dBi are used, the maximum conducted output power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6dBi.

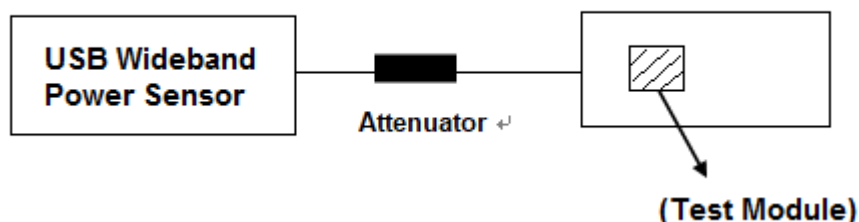
(4) According to KDB662911D01 Measure-and-sum technique, the conducted emission level (e.g., transmit power or power in specified bandwidth) is measured at each antenna port. The measured results at the various antenna ports are then summed mathematically to determine the total emission level from the device. Summing is performed in units that are directly proportional to power.

(5) According to KDB 662911 D01, the directional gain =  $G_{\text{ANT}} + 10\log(N_{\text{ANT}})\text{dBi}$ , where  $G_{\text{ANT}}$  is the antenna gain in dBi,  $N_{\text{ANT}}$  is the number of outputs.

### 2.3.2. Test Description

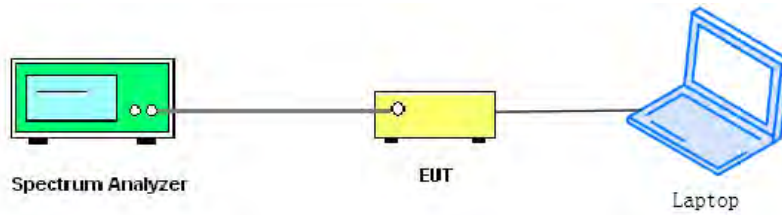
Section E) 3) of KDB 789033 defines a methodology using a USB Wideband Power Sensor.

#### Test Setup:



The EUT (Equipment under the test) which is coupled to the USB Wideband Power Sensor; the RF load attached to the EUT antenna terminal is 50Ohm; the path loss as the factor is calibrated to correct the reading, all test result in USB Wideband Power Sensor.

**For ac (VHT80) mode power**



The EUT (Equipment under the test) is coupled to the Spectrum analyzer; the RF load attached to the EUT antenna terminal is 50Ohm; the path loss as the factor is calibrated to correct the reading, all test result in Spectrum analyzer.

**2.3.3. Limits**

For the 5.25-5.35 GHz and 5.47-5.725 GHz bands, the maximum conducted output power over the frequency bands of operation shall not exceed the lesser of 250 mW or 11 dBm + 10 log B, where B is the 26 dB emission bandwidth in megahertz.

Mode	Band	Channel (MHz)	26dB BW (MHz)	11+10log(26dB BW)	Limits (dBm)
a	UNII-2a	5260	36.21	26.59	24.00
		5300	35.96	26.56	24.00
		5320	33.52	26.25	24.00
	UNII-2c	5500	35.37	26.49	24.00
		5600	34.09	26.33	24.00
		5720	37.53	26.74	24.00
n20	UNII-2a	5260	32.98	26.18	24.00
		5300	29.85	25.75	24.00
		5320	30.47	25.84	24.00
	UNII-2c	5500	32.51	26.12	24.00
		5600	33.67	26.27	24.00
		5720	33.79	26.29	24.00
ac20	UNII-2a	5260	32.98	26.18	24.00
		5300	29.85	25.75	24.00
		5320	30.47	25.84	24.00
	UNII-2c	5500	32.51	26.12	24.00
		5600	33.67	26.27	24.00
		5720	33.79	26.29	24.00





2.3.4. Test Result

Maximum Average Conducted Output Power

802.11a Mode

Frequency (MHz)	Average Power				Limit		Verdict
	Measured	Duty Factor	Duty factor Calculated		dBm	W	
	dBm		dBm	W			
5180	13.36	0.09	13.45	0.022	24	0.25	PASS
5220	18.63		18.72	0.074			
5240	16.40		16.49	0.045			
5260	19.65		<b>19.74</b>	<b>0.094</b>			
5300	17.99		18.08	0.064			
5320	13.58		13.67	0.023			
5500	17.88		17.97	0.063			
5600	17.07		17.16	0.052			
5720	16.59		16.68	0.047			
5745	16.42		16.51	0.045	30	1	
5785	16.21		16.30	0.043			
5825	16.35		16.44	0.044			

802.11n (HT20) Mode

Frequency (MHz)	Average Power				Limit		Verdict
	Measured	Duty Factor	Duty factor Calculated		dBm	W	
	dBm		dBm	W			
5180	16.54	0.09	16.63	0.046	24	0.25	PASS
5220	16.46		16.55	0.045			
5240	16.58		16.67	0.046			
5260	16.69		16.78	0.048			
5300	16.65		16.74	0.047			
5320	16.73		16.82	0.048			
5500	16.84		<b>16.93</b>	<b>0.049</b>			
5600	16.14		16.23	0.042			
5720	15.66		15.75	0.038			
5745	15.52		15.61	0.036	30	1	
5785	15.31		15.40	0.035			
5825	15.49		15.58	0.036			



**802.11n (HT40) Mode**

Frequency (MHz)	Average Power				Limit		Verdict
	Measured	Duty Factor	Duty factor Calculated		dBm	W	
	dBm		dBm	W			
5190	10.77	0.17	10.94	0.012	24	0.25	PASS
5230	17.12		17.29	0.054			
5270	17.19		<b>17.36</b>	<b>0.054</b>			
5310	14.02		14.19	0.026			
5510	11.04		11.21	0.013			
5630	16.61		16.78	0.048			
5710	13.17		13.34	0.022			
5755	16.28		16.45	0.044	30	1	
5795	15.93		16.10	0.041			

**802.11ac (VHT20) Mode**

Frequency (MHz)	Average Power				Limit		Verdict
	Measured	Duty Factor	Duty factor Calculated		dBm	W	
	dBm		dBm	W			
5180	16.50	0.09	16.59	0.046	24	0.25	PASS
5220	16.48		16.57	0.045			
5240	16.60		16.69	0.047			
5260	16.71		16.80	0.048			
5300	16.65		16.74	0.047			
5320	16.76		16.85	0.048			
5500	16.88		<b>16.97</b>	<b>0.050</b>			
5600	16.12		16.21	0.042			
5720	15.65		15.74	0.037			
5745	15.52		15.61	0.036			
5785	15.26		15.35	0.034			
5825	15.46		15.55	0.036			



**802.11ac (VHT40) Mode**

Frequency (MHz)	Average Power				Limit		Verdict
	Measured	Duty Factor	Duty factor Calculated		dBm	W	
	dBm		dBm	W			
5190	17.04	0.16	17.20	0.052	24	0.25	PASS
5230	17.10		17.26	0.053			
5270	17.23		17.39	0.055			
5310	17.37		<b>17.53</b>	<b>0.057</b>			
5510	17.37		17.53	0.057			
5630	16.60		16.76	0.047			
5710	16.18		16.34	0.043			
5755	15.97		16.13	0.041	30	1	
5795	15.83		15.99	0.040			

**802.11ac (VHT80) Mode**

Frequency (MHz)	Average Power				Limit		Verdict
	Measured	Duty Factor	Duty factor Calculated		dBm	W	
	dBm		dBm	W			
5210	6.11	0.33	6.44	0.004	24	0.25	PASS
5290	13.49		13.82	0.024			
5530	10.79		11.12	0.013			
5610	16.82		17.15	0.052			
5690	16.49		<b>16.82</b>	<b>0.048</b>			
5775	16.04		16.37	0.043	30	1	

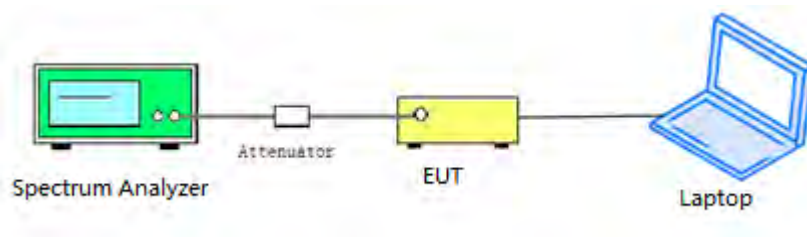
## 2.4. Emission Bandwidth

### 2.4.1. Requirement

For purposes of this subpart the emission bandwidth shall be determined by measuring the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, that are 26 dB down relative to the maximum level of the modulated carrier. Determination of the emissions bandwidth is based on the use of measurement instrumentation employing a peak detector function with an instrument resolution bandwidth approximately equal to 1.0 percent of the emission bandwidth of the device under measurement. Within the 5.725-5.85 GHz band, the minimum 6 dB bandwidth of U-NII devices shall be at least 500 kHz.

### 2.4.2. Test Description

#### Test Setup:



The EUT is coupled to the Spectrum Analyzer; the RF load attached to the EUT antenna terminal is 50 Ohm; the path loss as the factor is calibrated to correct the reading.

### 2.4.3. Test Procedure

1. KDB 789033 Section C) 1) Emission Bandwidth was used in order to prove compliance
  - a) Set RBW = approximately 1% of the emission bandwidth.
  - b) Set VBW > RBW.
  - c) Detector = Peak.
  - d) Trace mode = max hold.
  - e) Measure the maximum width of the emission that is 26 dB down from the peak of the emission. Compare this with the RBW setting of the analyzer. Readjust RBW and repeat measurement as needed until the RBW/EBW ratio is approximately 1%.
2. KDB 789033 Section C) 2) minimum emission bandwidth for the band 5.725-5.85GHz was used in order to prove compliance.  
Section 15.407(e) specifies the minimum 6 dB emission bandwidth of at least 500 KHz for the band 5.715-5.85 GHz. The following procedure shall be used for measuring this bandwidth:



- a) Set RBW = 100 kHz.
- b) Set video bandwidth (VBW)  $\geq 3 \times$  RBW.
- c) Detector = Peak.
- d) Trace mode = max hold.
- e) Sweep = auto couple.
- f) Allow the trace to stabilize.
- g) Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission.

#### 2.4.4. Test Result

##### 802.11a Mode

##### A. Test Verdict:

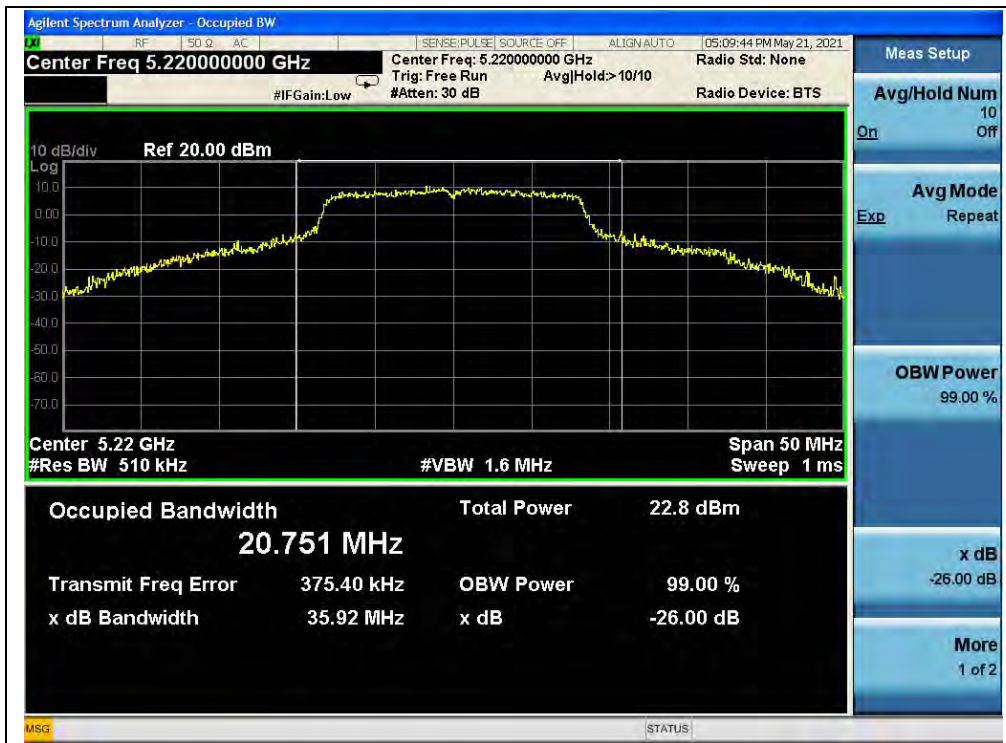
Channel	Frequency (MHz)	26 dB Bandwidth (MHz)
36	5180	37.49
44	5220	35.92
48	5240	37.40
52	5260	36.21
60	5300	35.96
64	5320	33.52
100	5500	35.37
120	5600	34.09
144	5720	37.53
Channel	Frequency (MHz)	6 dB Bandwidth (MHz)
144	5720	16.01
149	5745	14.39
157	5785	16.02
165	5825	15.11



B. Test Plot:



(Channel 36, 5180MHz, 802.11a)



(Channel 44, 5220 MHz, 802.11a)



(Channel 48, 5240MHz, 802.11a)



(Channel 52, 5260MHz, 802.11a)



(Channel 60, 5300 MHz, 802.11a)



(Channel 64, 5320MHz, 802.11a)

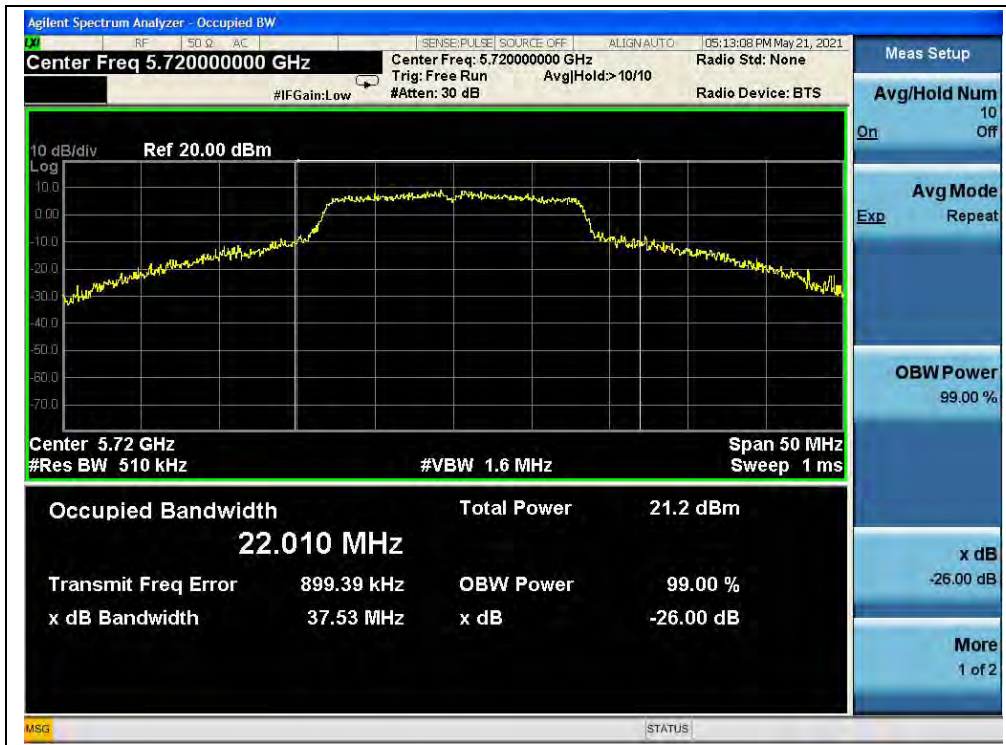




(Channel 100,5500MHz, 802.11a)



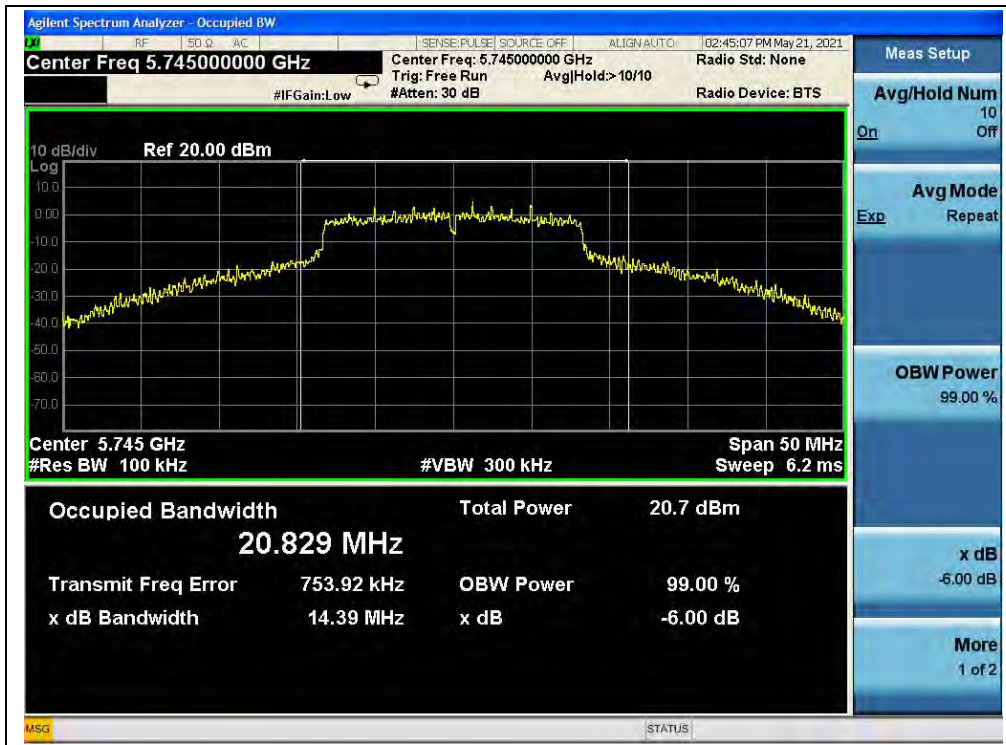
(Channel 120, 5600 MHz, 802.11a)



(Channel 144, 5720MHz, 802.11a)



(Channel 144, 5720MHz, 802.11a)



(Channel 149,5745MHz, 802.11a)



(Channel 157,5785MHz, 802.11a)



(Channel 165, 5825MHz, 802.11a)



802.11n (HT20) Mode

A. Test Verdict:

Channel	Frequency (MHz)	26 dB Bandwidth (MHz)
36	5180	32.59
44	5220	33.66
48	5240	30.52
52	5260	30.84
60	5300	30.18
64	5320	30.08
100	5500	32.62
120	5600	34.13
144	5720	35.65
Channel	Frequency (MHz)	6 dB Bandwidth (MHz)
144	5720	15.96
149	5745	16.99
157	5785	15.09
165	5825	17.22

B. Test Plot:



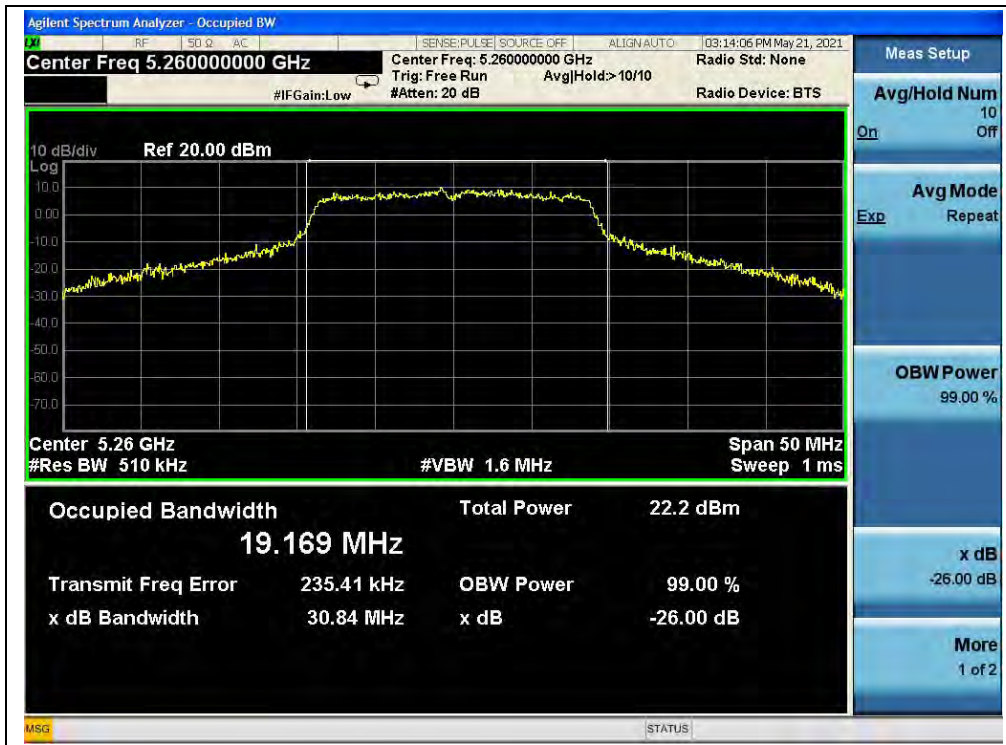
(Channel 36, 5180MHz, 802.11n (HT20))



(Channel 44, 5220MHz, 802.11n (HT20))



(Channel 48, 5240MHz, 802.11n (HT20))



(Channel 52, 5260MHz, 802.11n (HT20))



(Channel 60, 5300MHz, 802.11n (HT20))



(Channel 64, 5320MHz, 802.11n (HT20))



(Channel 100, 5500MHz, 802.11n (HT20))





(Channel 120, 5600MHz, 802.11n (HT20))



(Channel 144, 5720MHz, 802.11n (HT20))



(Channel 144, 5720MHz, 802.11 n (HT20))



(Channel 149, 5745MHz, 802.11 n (HT20))



(Channel 157, 5785MHz, 802.11 n (HT20))



(Channel 165, 5825MHz, 802.11 n (HT20))

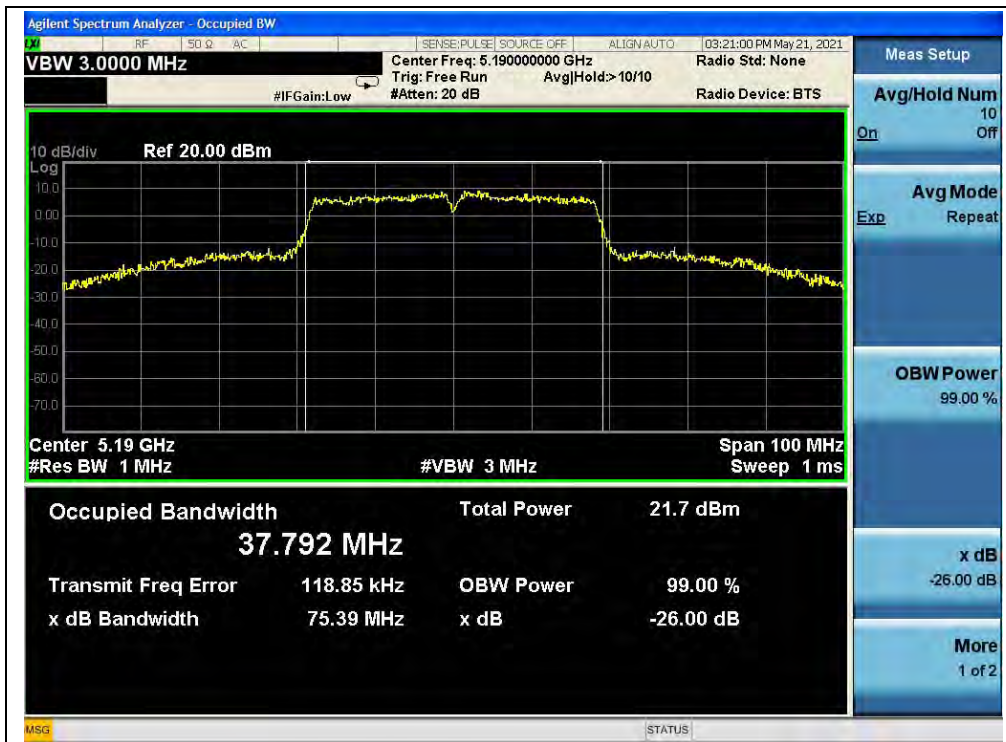


802.11n (HT40) Test mode

A. Test Verdict:

Channel	Frequency (MHz)	26 dB Bandwidth (MHz)
38	5190	75.39
46	5230	75.67
54	5270	72.11
62	5310	71.44
102	5510	77.77
126	5630	76.87
142	5710	77.08
Channel	Frequency (MHz)	6 dB Bandwidth (MHz)
142	5710	36.29
151	5755	36.34
159	5795	36.01

B. Test Plot:



(Channel 38, 5190MHz, 802.11n (HT40))



(Channel 46, 5230MHz, 802.11n (HT40))



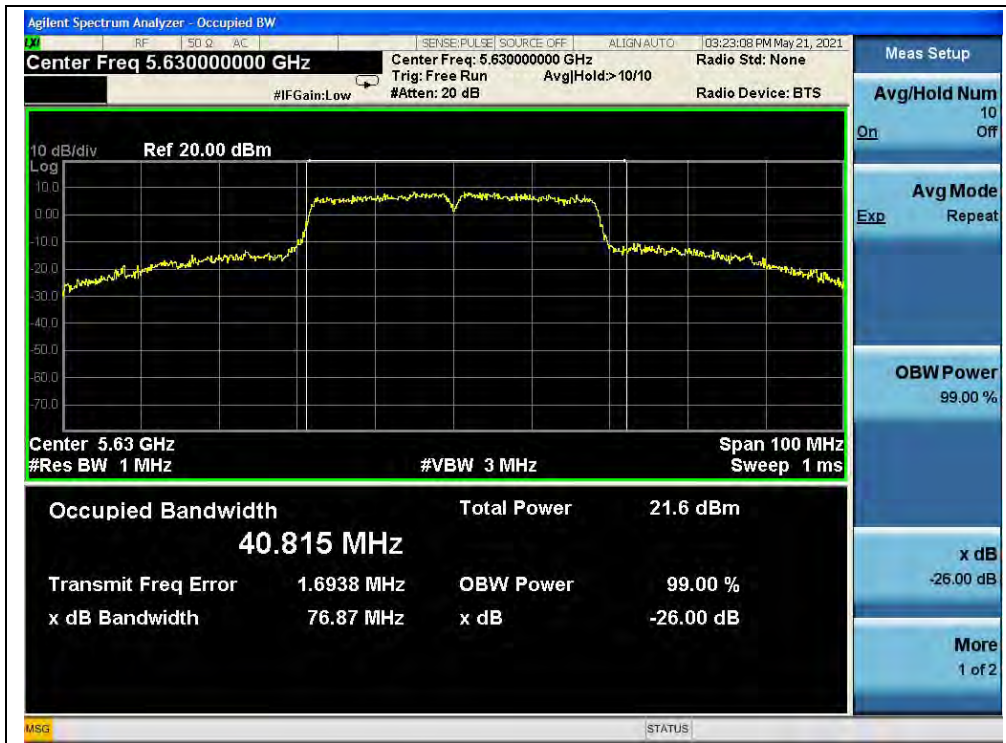
(Channel 54, 5270MHz, 802.11n (HT40))



(Channel 62, 5310MHz, 802.11n (HT40))



(Channel 102, 5510MHz, 802.11n (HT40))



(Channel 126, 5630MHz, 802.11n (HT40))



(Channel 142, 5710MHz, 802.11n (HT40))

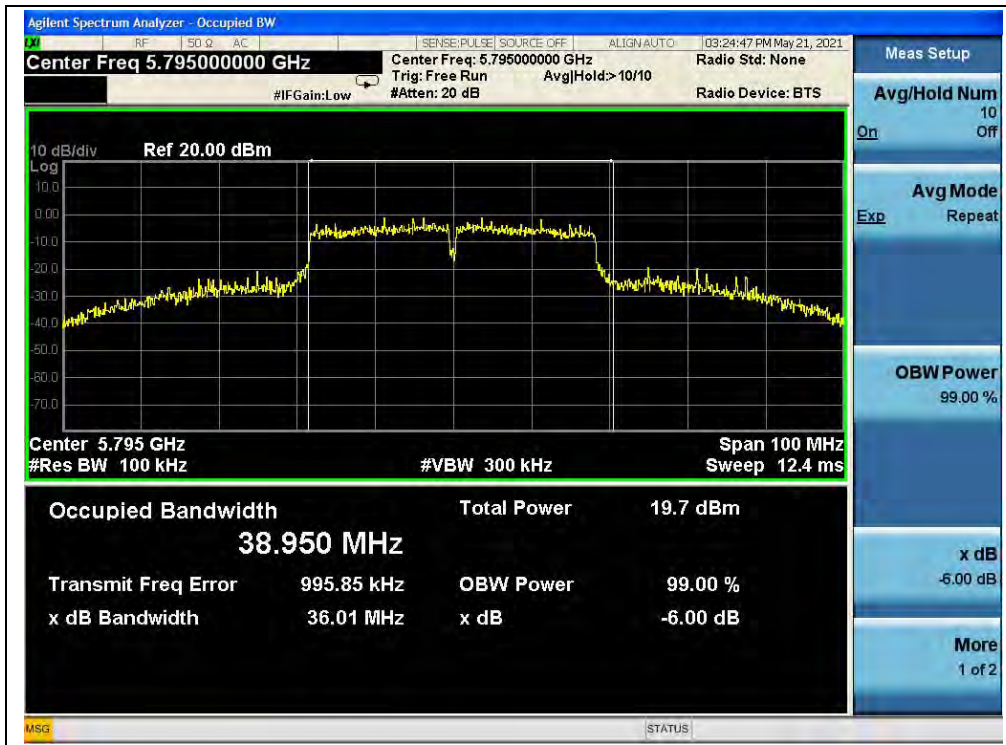


(Channel 142, 5710MHz, 802.11n (HT40))



(Channel 151, 5755MHz, 802.11n (HT40))





(Channel 159, 5795MHz, 802.11n (HT40))



802.11ac (VHT20) Mode

A. Test Verdict:

Channel	Frequency (MHz)	26 dB Bandwidth (MHz)
36	5180	31.67
44	5220	32.71
48	5240	30.78
52	5260	32.98
60	5300	29.85
64	5320	30.47
100	5500	32.51
120	5600	33.67
144	5720	33.79
Channel	Frequency (MHz)	6 dB Bandwidth (MHz)
144	5720	15.98
149	5745	17.23
157	5785	16.51
165	5825	17.58

B. Test Plot:



(Channel 36, 5180MHz, 802.11ac (VHT20))



(Channel 44, 5220MHz, 802.11ac (VHT20))



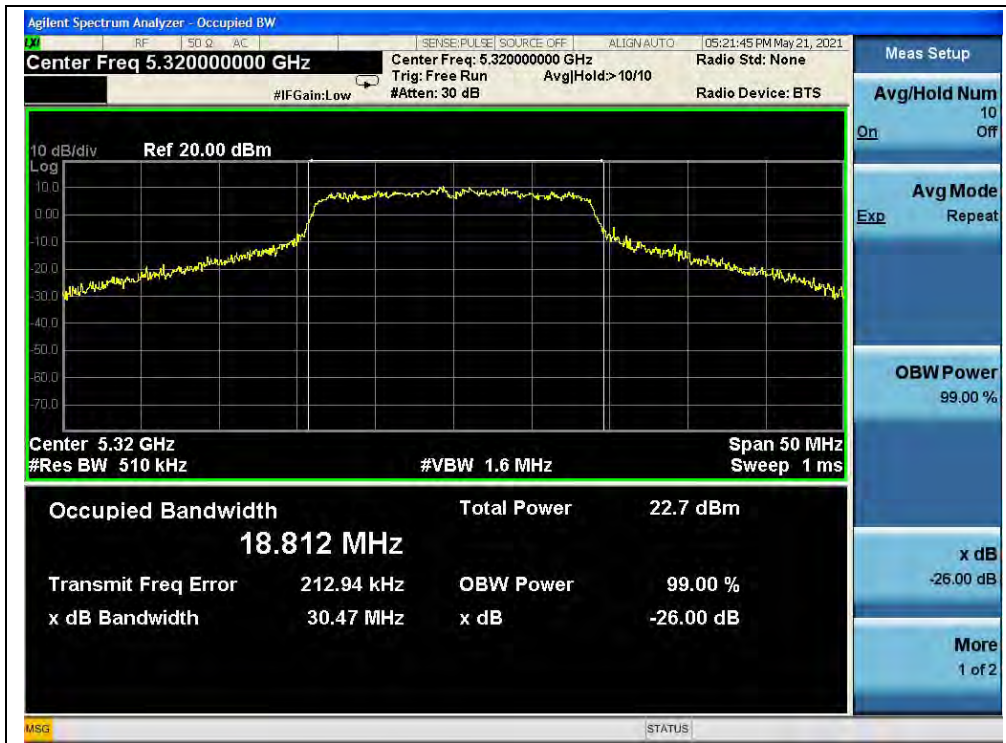
(Channel 48, 5240MHz, 802.11ac (VHT20))



(Channel 52, 5260MHz, 802.11ac (VHT20))



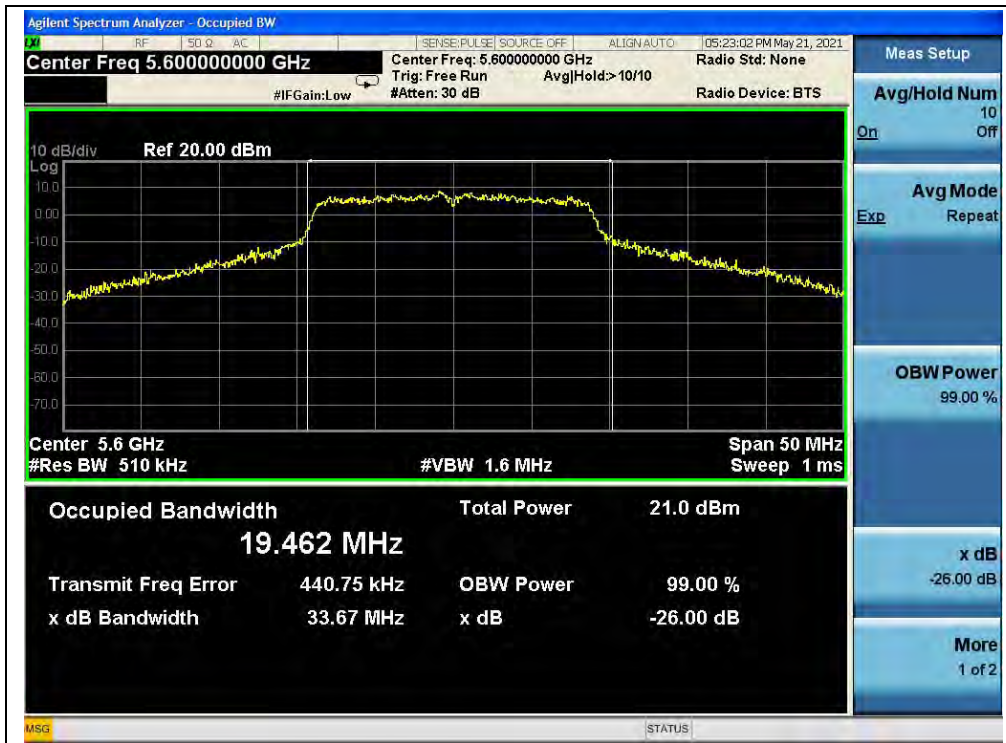
(Channel 60, 5300MHz, 802.11ac (VHT20))



(Channel 64, 5320MHz, 802.11ac (VHT20))



(Channel 100, 5500MHz, 802.11ac (VHT20))



(Channel 120, 5600MHz, 802.11ac (VHT20))



(Channel 144, 5720MHz, 802.11ac (VHT20))



(Channel 144, 5720MHz, 802.11ac (VHT20))



(Channel 149, 5745MHz, 802.11 ac (VHT20))



(Channel 157, 5785MHz, 802.11 ac (VHT20))



(Channel 165, 5825MHz, 802.11 ac (VHT20))





802.11ac (VHT40) Mode

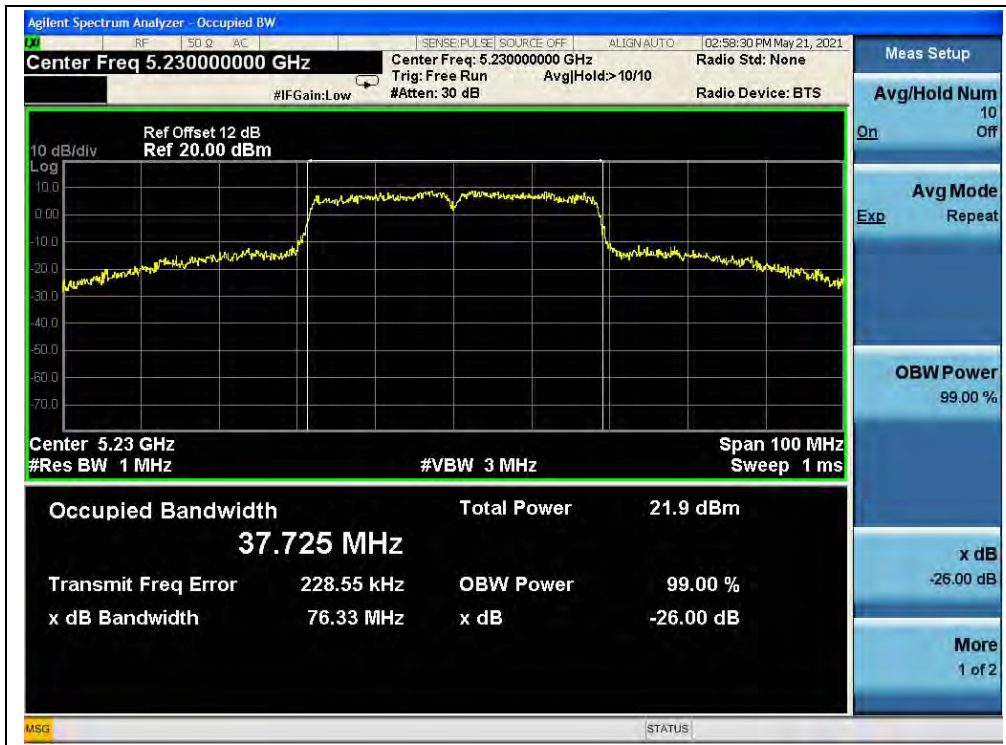
A. Test Verdict:

Channel	Frequency (MHz)	26 dB Bandwidth (MHz)
38	5190	83.96
46	5230	76.33
54	5270	73.37
62	5310	70.93
102	5510	78.42
126	5630	74.06
142	5710	78.36
Channel	Frequency (MHz)	6 dB Bandwidth (MHz)
142	5710	36.02
151	5755	36.06
159	5795	36.35

B. Test Plot:



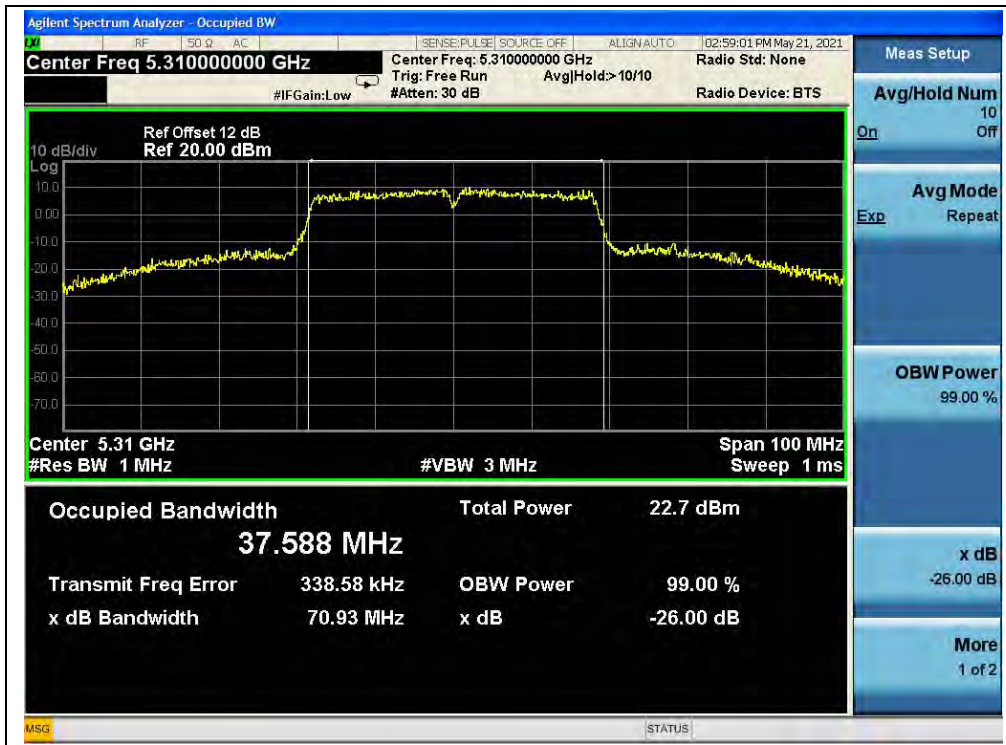
(Channel 38, 5190MHz, 802.11ac (VHT40))



(Channel 46, 5230MHz, 802.11ac (VHT40))



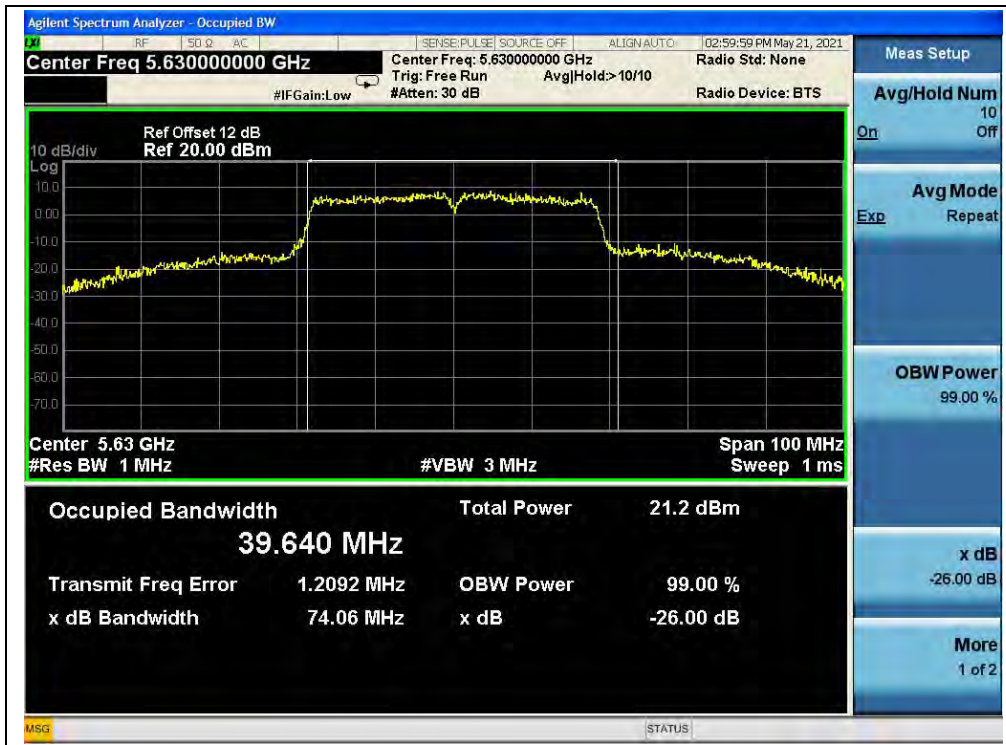
(Channel 54, 5270MHz, 802.11ac (VHT40))



(Channel 62, 5310MHz, 802.11ac (VHT40))



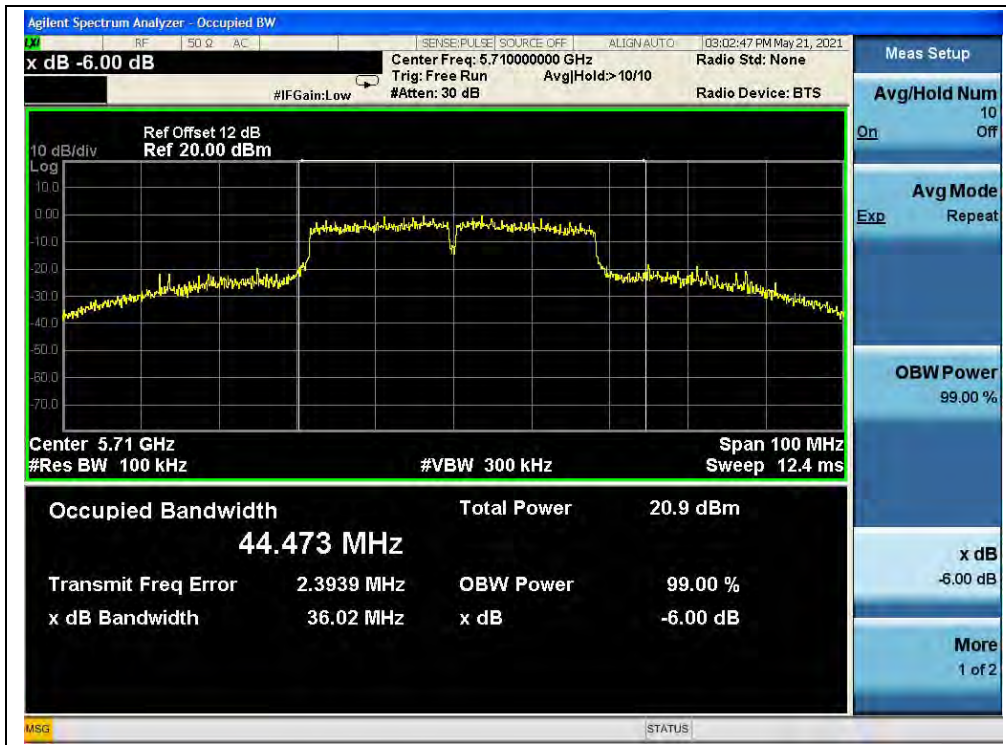
(Channel 102, 5510MHz, 802.11ac (VHT40))



(Channel 126, 5630MHz, 802.11ac (VHT40))



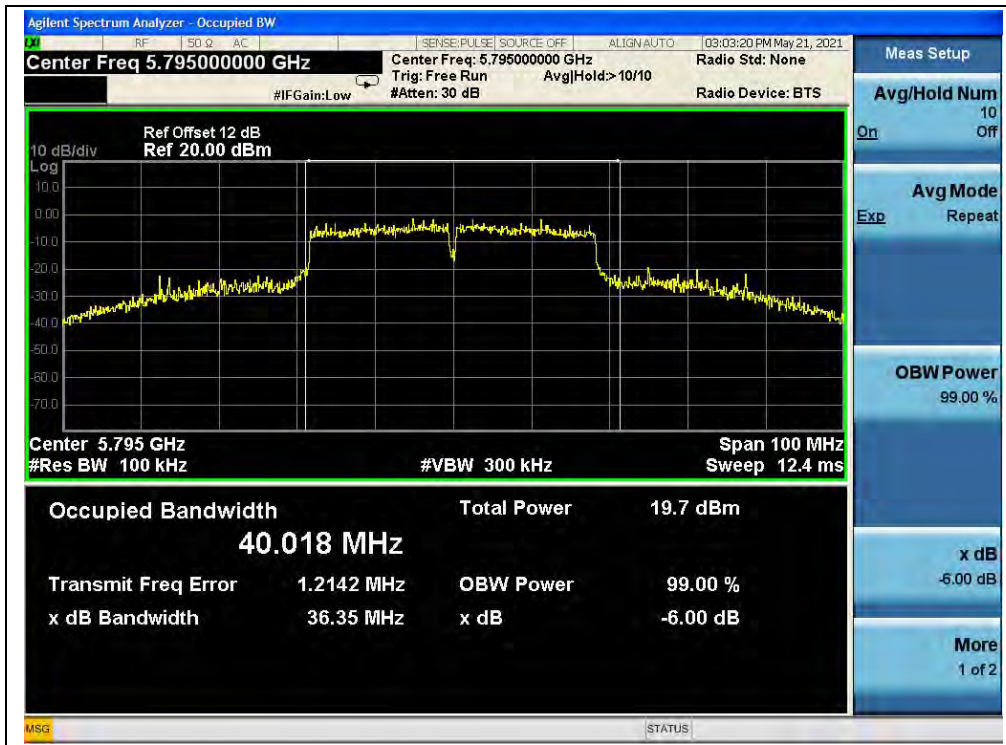
(Channel 142, 5710MHz, 802.11ac (VHT40))



(Channel 142, 5710MHz, 802.11ac (VHT40))



(Channel 151, 5755MHz, 802.11ac (VHT40))



(Channel 159, 5795MHz, 802.11ac (VHT40))

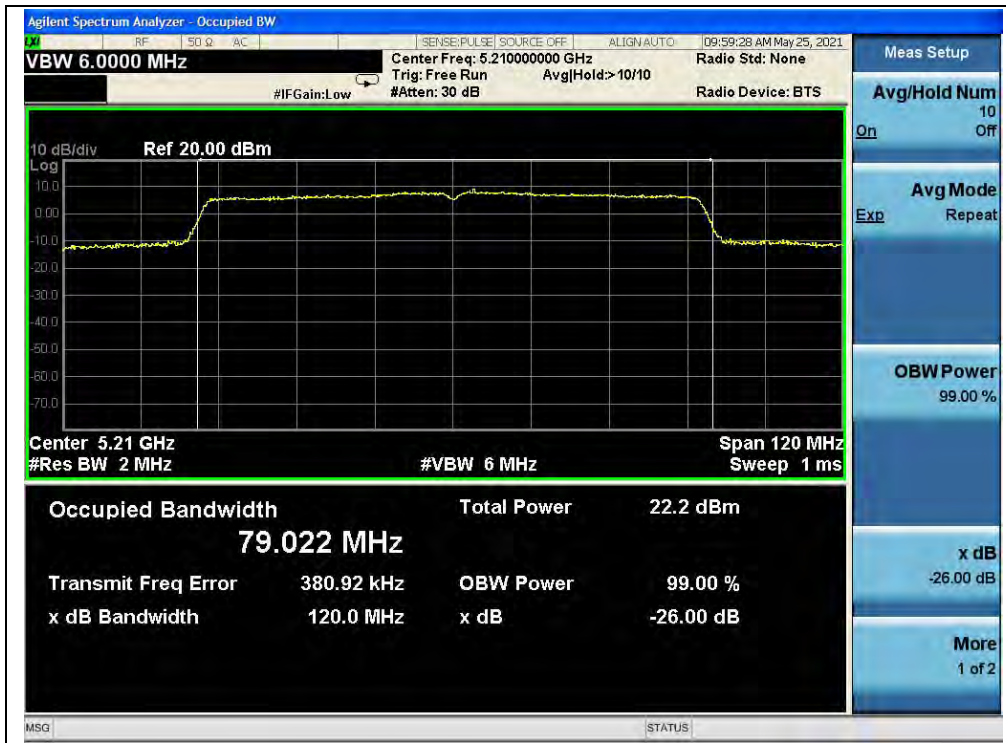


802.11ac (VHT80) Mode

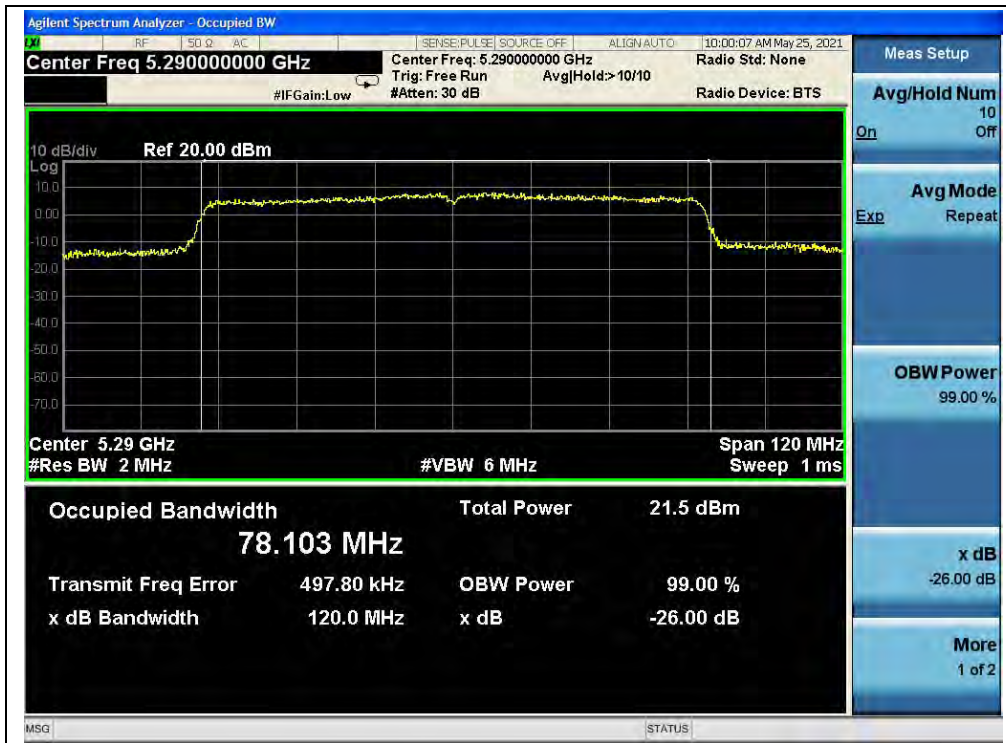
A. Test Verdict:

Channel	Frequency (MHz)	26 dB Bandwidth (MHz)
42	5210	120.00
58	5290	120.00
106	5530	120.00
122	5610	120.00
138	5690	120.00
Channel	Frequency (MHz)	6 dB Bandwidth (MHz)
138	5690	75.14
155	5775	75.63

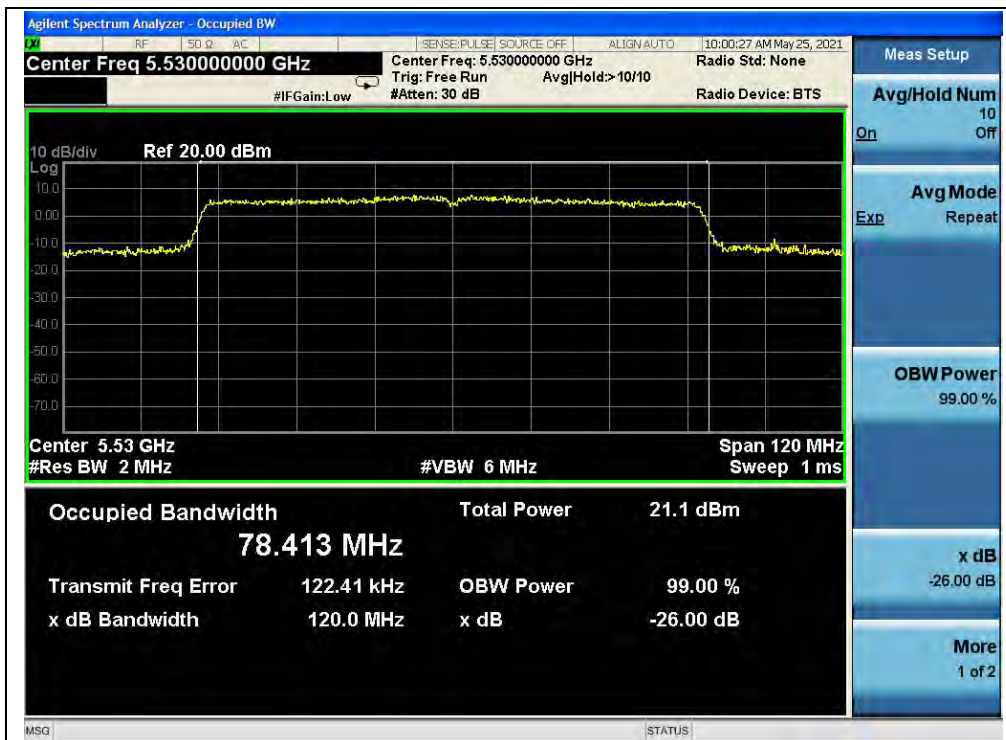
B. Test Plot:



(Channel 42, 5210MHz, 802.11ac (VHT80))

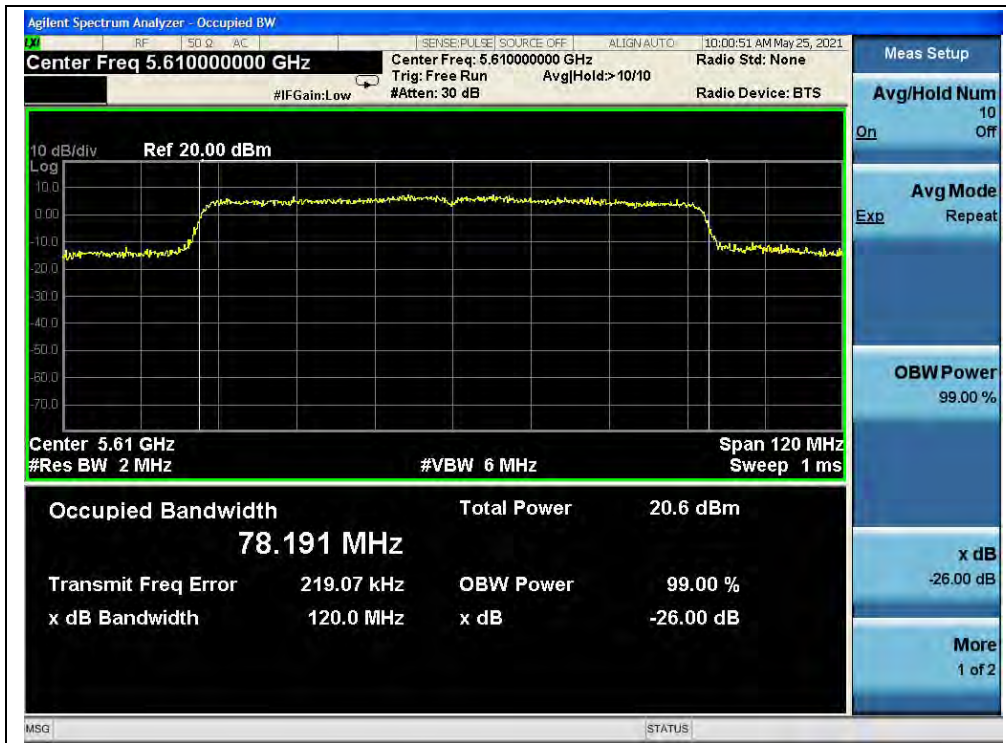


(Channel 58, 5290MHz, 802.11ac (VHT80))

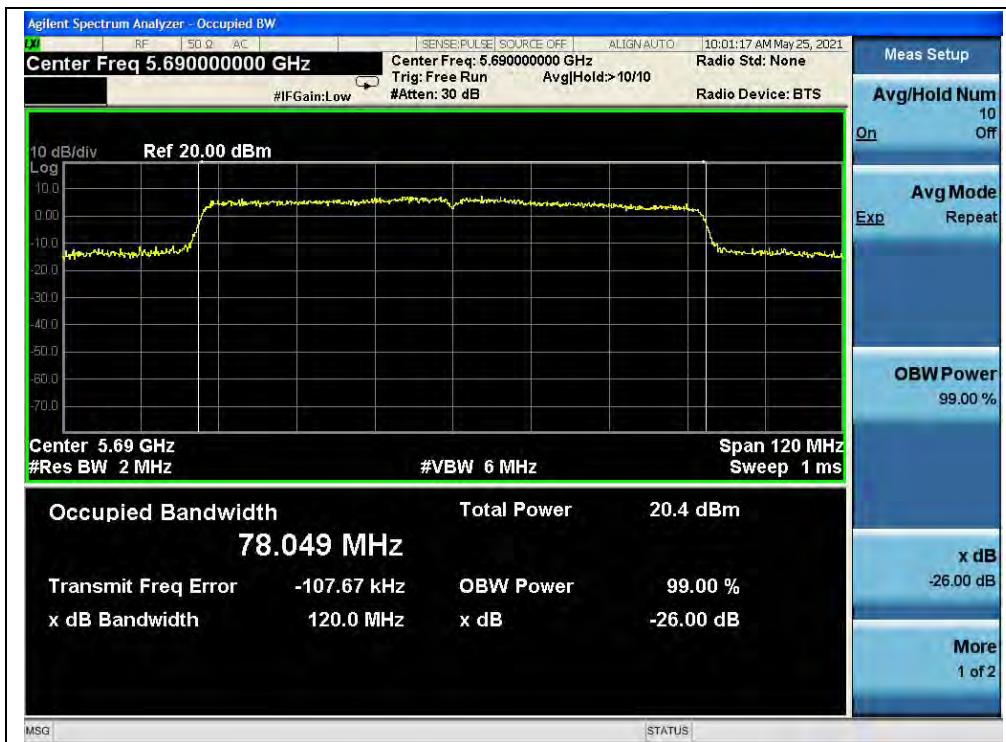


(Channel 106, 5530MHz, 802.11ac (VHT80))

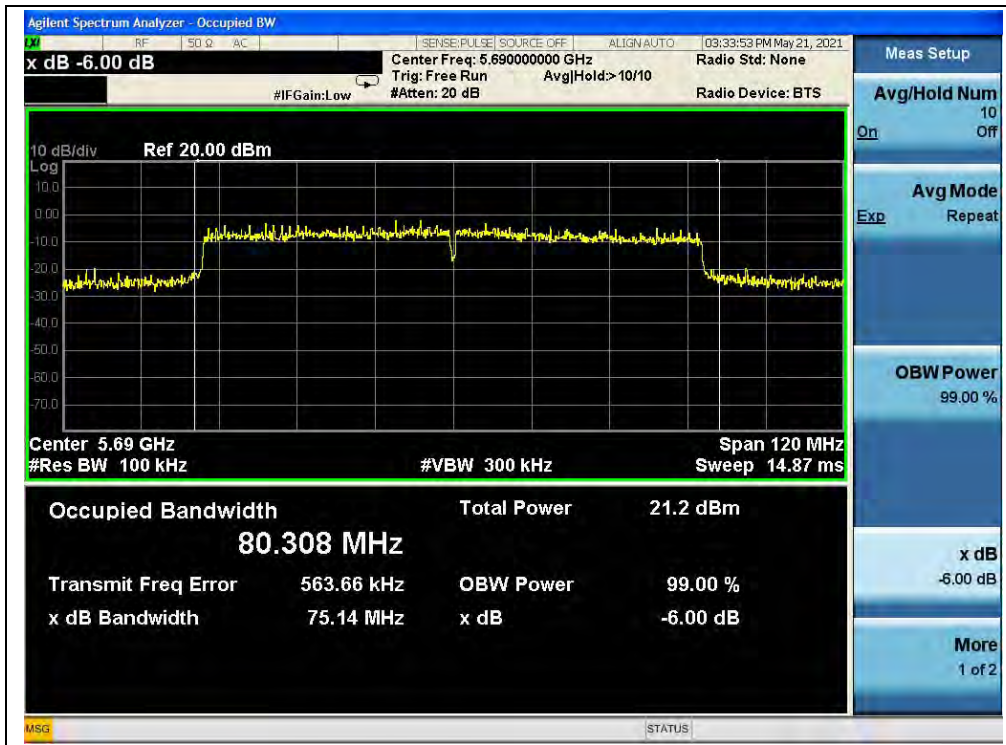




(Channel 122, 5610MHz, 802.11ac (VHT80))



(Channel 138, 5690MHz, 802.11ac (VHT80))



(Channel 138, 5690MHz, 802.11ac (VHT80))



(Channel 155, 5775MHz, 802.11ac (VHT80))

## 2.5. Peak Power Spectral Density

### 2.5.1. Requirement

(1) For client devices in the 5.15-5.25 GHz band, the maximum power spectral density shall not exceed 11dBm in any 1 megahertz band.

(2) For the 5.25-5.35 GHz and 5.47-5.725 GHz bands, the maximum power spectral density shall not exceed 11dBm in any 1 megahertz band.

(3) For the band 5.725-5.85 GHz, the maximum power spectral density shall not exceed 30dBm in any 500kHz band.

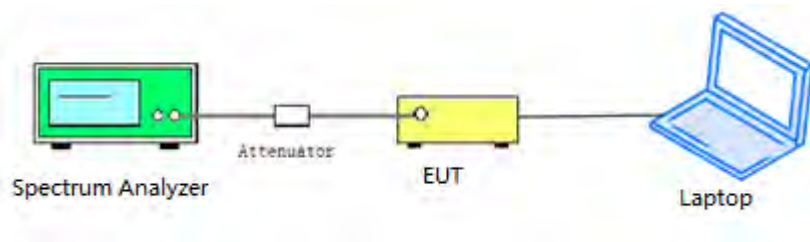
If transmitting antennas of directional gain greater than 6dBi are used, the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6dBi.

(4) According to KDB662911D01 Measure-and-sum technique, the conducted emission level (e.g., transmit power or power in specified bandwidth) is measured at each antenna port. The measured results at the various antenna ports are then summed mathematically to determine the total emission level from the device. Summing is performed in units that are directly proportional to power.

(5) According to KDB 662911 D01, the directional gain =  $G_{ANT} + 10\log(N_{ANT})$  dBi, where  $G_{ANT}$  is the antenna gain in dBi,  $N_{ANT}$  is the number of outputs.

### 2.5.2. Test Description

#### Test Setup:



The EUT is coupled to the Spectrum Analyzer; the RF load attached to the EUT antenna terminal is 50Ohm; the path loss as the factor is calibrated to correct the reading.



**2.5.3. Test Procedure**

KDB 789033 Section F) Maximum Power Spectral Density (PSD) Method SA-3 was used in order to prove compliance

- 1) Set span to encompass the entire 26-dB emission bandwidth
- 2) Set RBW = 1MHz. Set VBW ≥ 3MHz
- 3) Number of points in sweep ≥ 2 Span / RBW. Sweep time = auto
- 4) Detector = Average
- 5) Trace mode=Max hold
- 6) Record the max value

**2.5.4. Test Result**

**802.11a Mode**

**A. Test Verdict:**

Channel	Frequency (MHz)	Measured PPSD (dBm/MHz)	Duty Factor	Corrected PPSD (dBm/MHz)	Limit (dBm/MHz)	Verdict
36	5180	6.95	0.09	7.04	11	PASS
44	5220	7.27		7.36		
48	5240	7.34		7.43		
52	5260	7.53		7.62		
60	5300	7.61		7.70		
64	5320	7.60		7.69		
100	5500	6.98		7.07		
120	5600	6.08		6.17		
144	5720	5.61		5.70		
Channel	Frequency (MHz)	Measured PPSD (dBm/500KHz)		Duty Factor		
144	5720	2.81	0.09	2.90	30	PASS
149	5745	2.44		2.53		
157	5785	2.43		2.52		
165	5825	2.43		2.52		



B. Test Plot:



(Channel 36, 5180MHz, 802.11a)



(Channel 44, 5220MHz, 802.11a)



(Channel 48, 5240MHz, 802.11a)



(Channel 52, 5260MHz, 802.11a)



(Channel 60, 5300MHz, 802.11a)



(Channel 64, 5320MHz, 802.11a)



(Channel 100, 5500MHz, 802.11a)



(Channel 120, 5600MHz, 802.11a)





(Channel 144, 5720MHz, 802.11a)



(Channel 144, 5720MHz, 802.11a)



(Channel 149, 5745MHz, 802.11a)



(Channel 157, 5785MHz, 802.11a)



(Channel 165, 5825MHz, 802.11a)



**802.11n (HT20) Mode**

**A. Test Verdict:**

Channel	Frequency (MHz)	Measured PPSD (dBm/MHz)	Duty Factor	Corrected PPSD (dBm/MHz)	Limit (dBm/MHz)	Verdict
36	5180	5.14	0.09	5.23	11	PASS
44	5220	5.29		5.38		
48	5240	5.37		5.46		
52	5260	5.58		5.67		
60	5300	5.92		6.01		
64	5320	6.08		6.17		
100	5500	5.41		5.50		
120	5600	4.22		4.31		
144	5720	3.71		3.80		
Channel	Frequency (MHz)	Measured PPSD (dBm/500KHz)	Duty Factor	Corrected (dBm/500KHz)	Limit (dBm/500KHz)	Verdict
144	5720	1.48	0.09	1.57	30	PASS
149	5745	1.31		1.40		
157	5785	1.09		1.18		
165	5825	1.21		1.30		



B. Test Plot:



(Channel 36, 5180MHz, 802.11n (HT20))



(Channel 44, 5220MHz, 802.11n (HT20))



(Channel 48, 5240MHz, 802.11n (HT20))



(Channel 52, 5260MHz, 802.11n (HT20))



(Channel 60, 5300MHz, 802.11n (HT20))



(Channel 64, 5320MHz, 802.11n (HT20))



(Channel 100, 5500MHz, 802.11n (HT20))

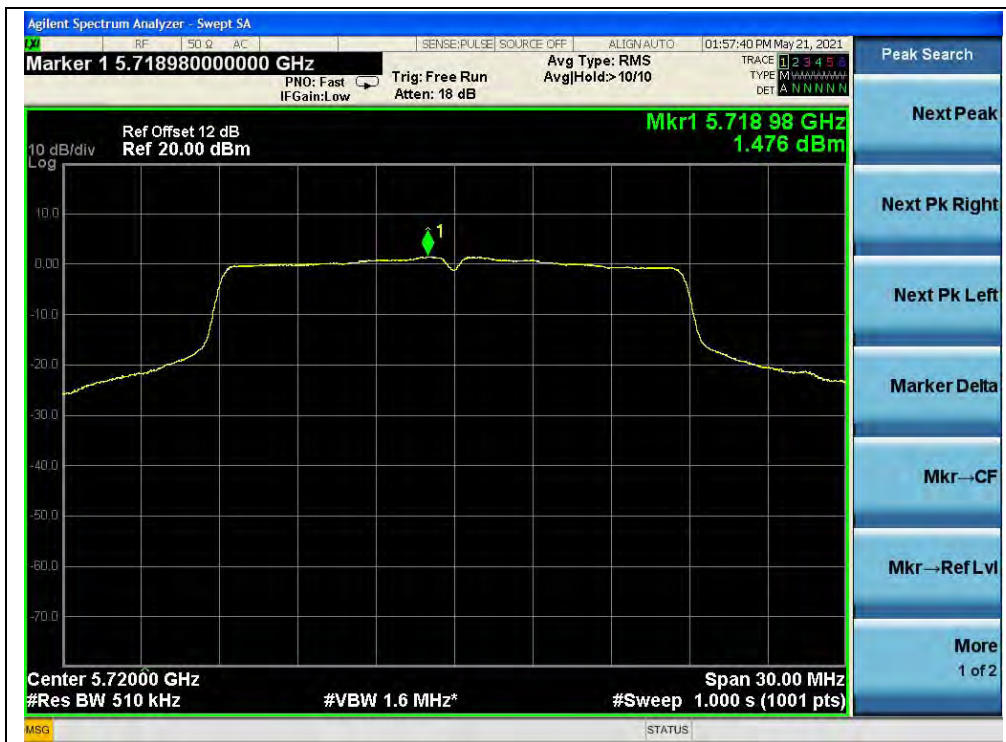


(Channel 120, 5600MHz, 802.11n (HT20))

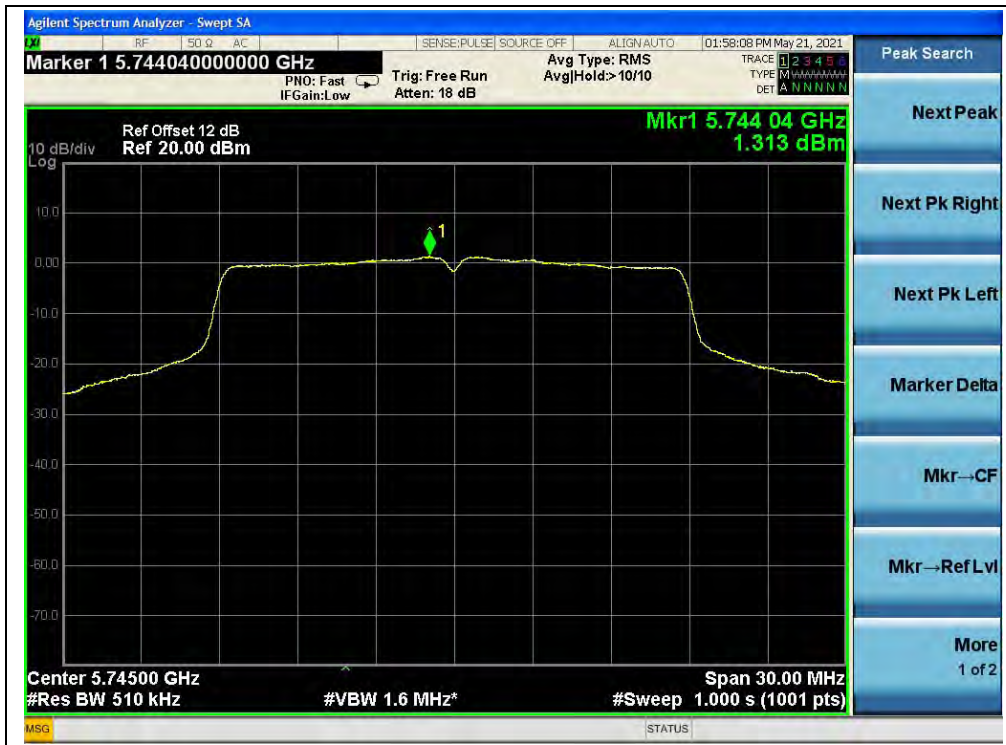




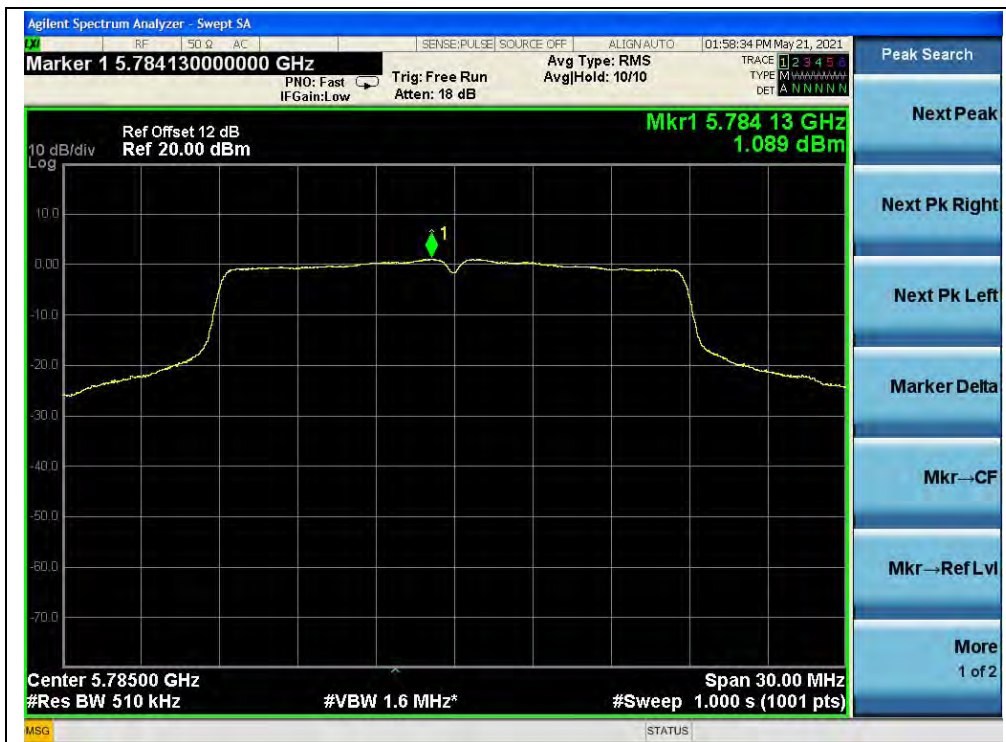
(Channel 144, 5720MHz, 802.11n (HT20))



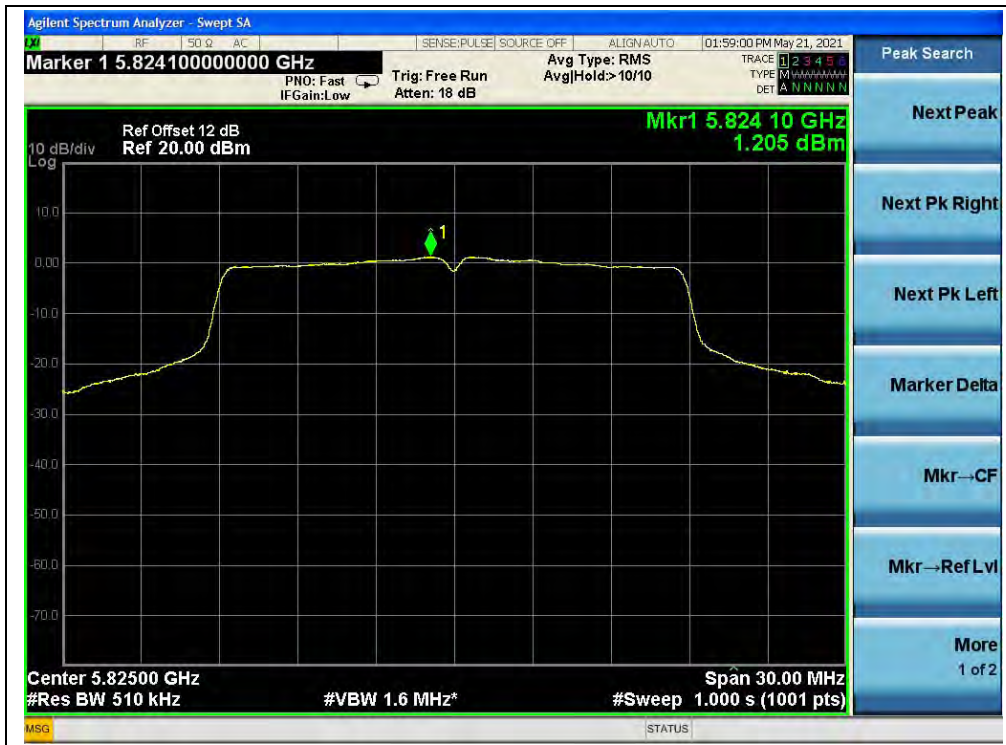
(Channel 144, 5720MHz, 802.11n (HT20))



(Channel 149, 5745MHz, 802.11n (HT20))



(Channel 157, 5785MHz, 802.11n (HT20))



(Channel 165, 5825MHz, 802.11n (HT20))



802.11n (HT40) Mode

A. Test Verdict:

Channel	Frequency (MHz)	Measured PPSD (dBm/MHz)	Duty Factor	Corrected PPSD (dBm/MHz)	Limit (dBm/MHz)	Verdict
38	5190	2.75	0.17	2.92	11	PASS
46	5230	3.12		3.29		
54	5270	3.30		3.47		
62	5310	3.76		3.93		
102	5510	2.98		3.15		
126	5630	2.45		2.62		
142	5710	1.89		2.06		
Channel	Frequency (MHz)	Measured PPSD (dBm/500KHz)	Duty Factor	Corrected (dBm/500KHz)	Limit (dBm/500KHz)	Verdict
142	5710	-0.96	0.17	-0.79	30	PASS
151	5755	-1.34		-1.17		
159	5795	-1.56		-1.39		

B. Test Plot:



(Channel 38, 5190MHz, 802.11n (HT40))



(Channel 46, 5230MHz, 802.11n (HT40))



(Channel 54, 5270MHz, 802.11n (HT40))



(Channel 62, 5310MHz, 802.11n (HT40))



(Channel 102, 5510MHz, 802.11n (HT40))



(Channel 126, 5630 MHz, 802.11n (HT40))



(Channel 142, 5710MHz, 802.11n (HT40))



(Channel 142, 5710MHz, 802.11n (HT40))



(Channel 151, 5755MHz, 802.11n (HT40))





(Channel 159, 5795MHz, 802.11n (HT40))